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What is Claimed:

- 1 1. A semiconductor device comprising:

2 a substrate having a first thermal expansion coefficient; and

3 an organic semiconductor material coupled to the substrate at an interface
4 therebetween, the organic semiconductor material having a second thermal expansion
5 coefficient that is different from the first thermal expansion coefficient, whereby a
6 mechanical stress is transferred from the substrate to the organic semiconductor material
7 through the interface, the mechanical stress being related to the difference between the
8 first thermal expansion coefficient and the second thermal expansion coefficient.
- 1 2. The semiconductor device of claim 1 wherein the mechanical stress is
2 a compressive stress transferred from the substrate to the organic semiconductor material
3 through the interface.
- 1 3. The semiconductor device of claim 2 wherein the compressive stress
2 decreases a distance between adjacent molecules in the organic semiconductor material,
3 thereby increasing carrier mobility of the organic semiconductor material.
- 1 4. The semiconductor device of claim 1 wherein the mechanical stress is
2 a tensile stress transferred from the substrate to the organic semiconductor material
3 through the interface.
- 1 5. The semiconductor device of claim 4 wherein the tensile stress
2 increases a distance between adjacent molecules in the organic semiconductor material,
3 thereby decreasing carrier mobility of the organic semiconductor material.
- 1 6. A method of fabricating a semiconductor device comprising:

2 providing a substrate having a first thermal expansion coefficient;

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3 coupling an organic semiconductor material to the substrate at an interface
4 therebetween, the organic semiconductor material having a second thermal expansion
5 coefficient different from the first thermal expansion coefficient; and

6 applying a mechanical stress to the organic semiconductor material through
7 the interface by varying a temperature of the substrate such that the substrate changes in
8 at least one physical dimension.

1 7. The method of claim 6 wherein the applying step includes applying a
2 compressive stress to the organic semiconductor material through the interface.

1 8. The method of claim 7 further comprising the step of decreasing a
2 distance between adjacent molecules in the organic semiconductor material, thereby
3 increasing carrier mobility of the organic semiconductor material.

1 9. The method of claim 6 wherein the applying step includes applying a
2 tensile stress to the organic semiconductor material through the interface.

1 10. The method of claim 9 further comprising the step of increasing a
2 distance between adjacent molecules in the organic semiconductor material, thereby
3 decreasing carrier mobility of the organic semiconductor material.

1 11. A semiconductor device comprising:

2 a substrate;

3 an organic semiconductor material coupled to the substrate at an interface
4 therebetween; and

5 an actuator provided for use with at least one of the substrate or the organic
6 semiconductor, the actuator being selected from the group comprising piezoelectric
7 actuators, piezomagnetic actuators, electrostrictive actuators, magnetostrictive actuators,
8 electrostatic actuators, magnetostatic actuators, shape memory alloy actuators, magnetic
9 shape memory alloy actuators, and electroactive polymer actuators, the actuator applying

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10 a mechanical force to at least one of the substrate or the organic semiconductor upon the
11 actuator being actuated, the mechanical force varying a carrier mobility of the organic
12 semiconductor.

1 12. The semiconductor device of claim 11 wherein the mechanical force is
2 a compressive stress, the compressive stress decreasing a distance between adjacent
3 molecules in the organic semiconductor material, thereby increasing carrier mobility of the
4 organic semiconductor material.

1 13. The semiconductor device of claim 11 wherein the mechanical force is
2 a tensile stress, the tensile stress increasing a distance between adjacent molecules in the
3 organic semiconductor material, thereby decreasing carrier mobility of the organic
4 semiconductor material.

1 14. The semiconductor device of claim 11 wherein the actuator is
2 integrated into at least one of the substrate or the organic semiconductor material.

1 15. A method of fabricating a semiconductor device comprising:

2 providing an organic semiconductor material coupled to a substrate;

3 providing an actuator for use with at least one of the substrate or the
4 organic semiconductor material, the actuator being selected from the group comprising
5 piezoelectric actuators, piezomagnetic actuators, electrostrictive actuators,
6 magnetostrictive actuators, electrostatic actuators, magnetostatic actuators, shape
7 memory alloy actuators, magnetic shape memory alloy actuators, and electroactive
8 polymer actuators; and

9 applying a mechanical force to at least one of the substrate or the organic
10 semiconductor material by actuating the actuator, the mechanical force varying a carrier
11 mobility of the organic semiconductor material.

1 16. The method of claim 15 wherein said applying step includes applying
2 a compressive stress to at least one of the substrate or the organic semiconductor material

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3 by actuating the actuator, the compressive stress decreasing a distance between adjacent
4 molecules in the organic semiconductor material, thereby increasing carrier mobility of the
5 organic semiconductor material.

1 17. The method of claim 15 wherein said applying step includes applying
2 a tensile stress to at least one of the substrate or the organic semiconductor material by
3 actuating the actuator, the tensile stress increasing a distance between adjacent molecules
4 in the organic semiconductor material, thereby decreasing carrier mobility of the organic
5 semiconductor material.

1 18. The method of claim 15 wherein said coupling step includes
2 integrating the actuator into at least one of the substrate or the organic semiconductor
3 material.

1 19. A semiconductor device comprising:

2 a semiconductor package; and

3 an organic semiconductor material provided within the semiconductor
4 package, the semiconductor package having a hydrostatic pressure applied thereto such
5 that the pressure within the semiconductor package is different from atmospheric
6 pressure, the applied hydrostatic pressure varying carrier mobility of the organic
7 semiconductor material.

1 20. The semiconductor device of claim 19 wherein the hydrostatic
2 pressure applies a compressive stress to the organic semiconductor material, the
3 compressive stress decreasing a distance between adjacent molecules in the organic
4 semiconductor material, thereby increasing carrier mobility of the organic semiconductor
5 material.

1 21. The semiconductor device of claim 19 wherein the hydrostatic
2 pressure applies a tensile stress to the organic semiconductor material, the tensile stress
3 increasing a distance between adjacent molecules in the organic semiconductor material,
4 thereby decreasing carrier mobility of the organic semiconductor material.

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1 22. The semiconductor device of claim 19 wherein the hydrostatic
2 pressure is provided by at least one of gaseous pressure, liquid pressure, gel pressure,
3 solid pressure, or a combination thereof.

1 23. A method of fabricating a semiconductor device comprising:

2 providing an organic semiconductor material in a semiconductor package;
3 and

4 applying a hydrostatic pressure to the semiconductor package such that the
5 pressure within the semiconductor package is different from atmospheric pressure, the
6 applied hydrostatic pressure varying carrier mobility of the organic semiconductor
7 material.

1 24. The method of claim 23 wherein said applying step includes applying,
2 through the hydrostatic pressure, a compressive stress to the organic semiconductor
3 material, the compressive stress decreasing a distance between adjacent molecules in the
4 organic semiconductor material, thereby increasing carrier mobility of the organic
5 semiconductor material.

1 25. The method of claim 23 wherein said applying step includes applying,
2 through the hydrostatic pressure, a tensile stress to the organic semiconductor material,
3 the tensile stress increasing a distance between adjacent molecules in the organic
4 semiconductor material, thereby decreasing carrier mobility of the organic semiconductor
5 material.

1 26. The method of claim 23 wherein said applying step includes applying
2 at least one of gaseous pressure, liquid pressure, gel pressure, solid pressure, or a
3 combination thereof into the semiconductor package.